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Amateur Television Quarterly

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Linking ATV Repeaters across state lines

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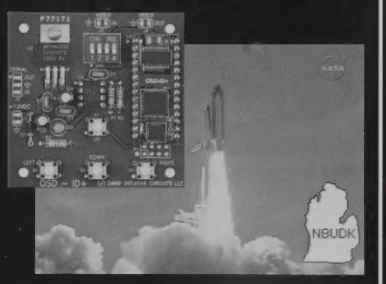

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Sync Buzz Editorial

Mike Collis WA6SVT

New Trends in ATV

IP streaming of ATV video is much more popular this year. Most of you are familiar with the BATC streaming site that allows BATC members and repeaters to stream their output over the Internet. A new video version of AR Newsline is now popular on some ATV nets and Ham Nation. This is published weekly at www.arnewsline.org. Click on "podcast" to download the video. Many ATV stations are using vMix software to allow multiple ATV video and IP streaming sources to be displayed. Now some repeaters are starting to run long distant links, see page 27 for more details.

Dayton Hamvention Changes

By now most of you have heard that the Hara Arena has closed and DARA has moved the Hamvention to the Green County Fairgrounds near Xenia Ohio about 20 miles southeast of the old location. We will have an ATV booth sponsored by ATN and an ATV forum. Come see the new digs in 2017.

ATVQ Staff

Bill is very busy at work with long hours and has had very little time to work on the magazine the last couple of years. Mike has taken care of magazine layout as well as running the office in Bill's absence. We would like to thank Don Hill KE6BXT for his help with the web site and cyber subscriptions, Art Towslee WA8RMC for help in editing review and Rod Fritz WB9KMO who is working on marketing. See our updated Facebook page. Thanks to all of this good work, our subscriptions have seen an increase since last spring and we added more advertisers too.

Next Issue

Articles for our winter issue are: ATCO Fall Event and ATN-AZ Winter meeting. We need more articles, so please send in your ATV news items and technical articles. This time of year, it is good to hear from our subscribers about the type of articles you would like to see in 2017. Your suggestions and comments are always welcome anytime.

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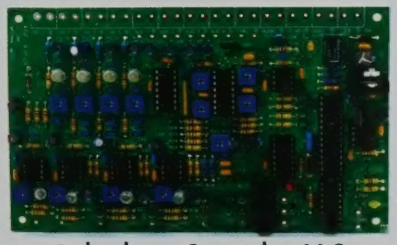

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From the all of us at ATVQ, we wish the best to you and your family this holiday season!

Stay tuned - Mike

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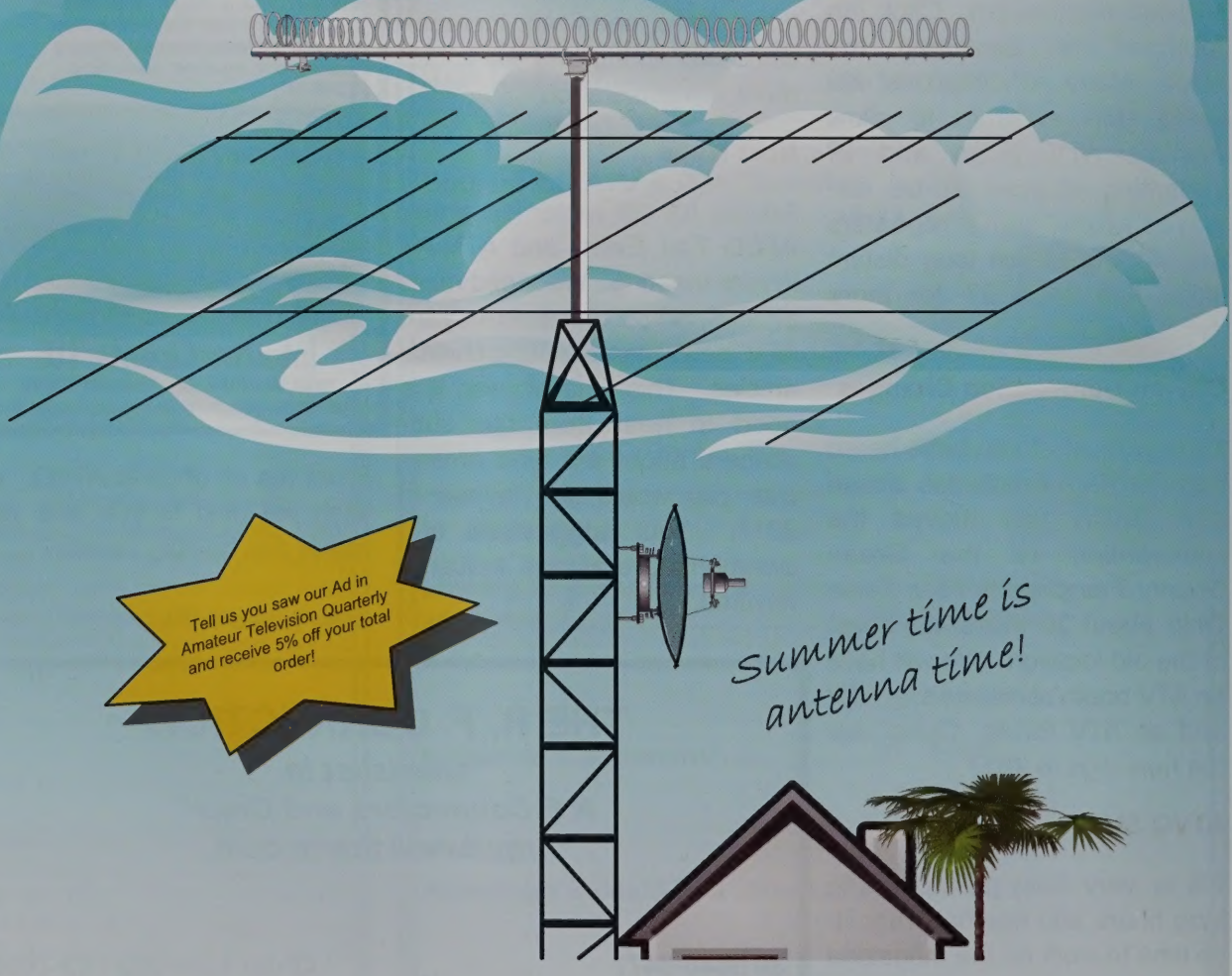

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An HDMI Switch for a Digital TV Repeater

-Jim Andrews KH6HTV www.kh6htv.com

While developing a new combination analog/digital Television repeater for Boulder, Colorado, the need was found to be able to switch easily between different HDMI sources. While such devices are available for broadcast studios, they were found to be very expensive. I wanted a very low cost switch that had KISS (Keep It Simple Stupid) technology that did not require computer control, nor tearing into the guts of other devices and reverse engineering.

A search on the internet for HDMI, multiple input switches results in many "hits" for low cost ($25) switches. Purchasing some of these showed that most all of them had one feature in common. They were all Auto Selector switches. Whenever a new HDMI source was turned on, the switch automatically moved to this input. This meant that they could not be reliably controlled by their front panel selector switch button, nor their supplied IR remote control.

Also any "glitch" in a selected HDMI input, and the switch automatically moved on to the next active HDMI input in sequence. This was unacceptable for reliable operation in a remotely located, unattended, TV repeater.

I discovered a low cost, no modification, solution to this auto switch dilemma. This was to exercise positive DC power control up-stream of the various HDMI sources before they got to the multi-input, auto, HDMI switch. If I only allowed a single HDMI source input to the auto switch to be active at any one time, then the auto switch locked onto it and stayed there, outputting the desired video. What I found worked quite well was to use a low cost, 1 in x 2 out HDMI splitter as my DC controlled switch. Thus simply turning on or off the +5Vdc to the splitter accomplished my control of that particular HDMI source. The block diagram, Fig. 1, shows the concept.

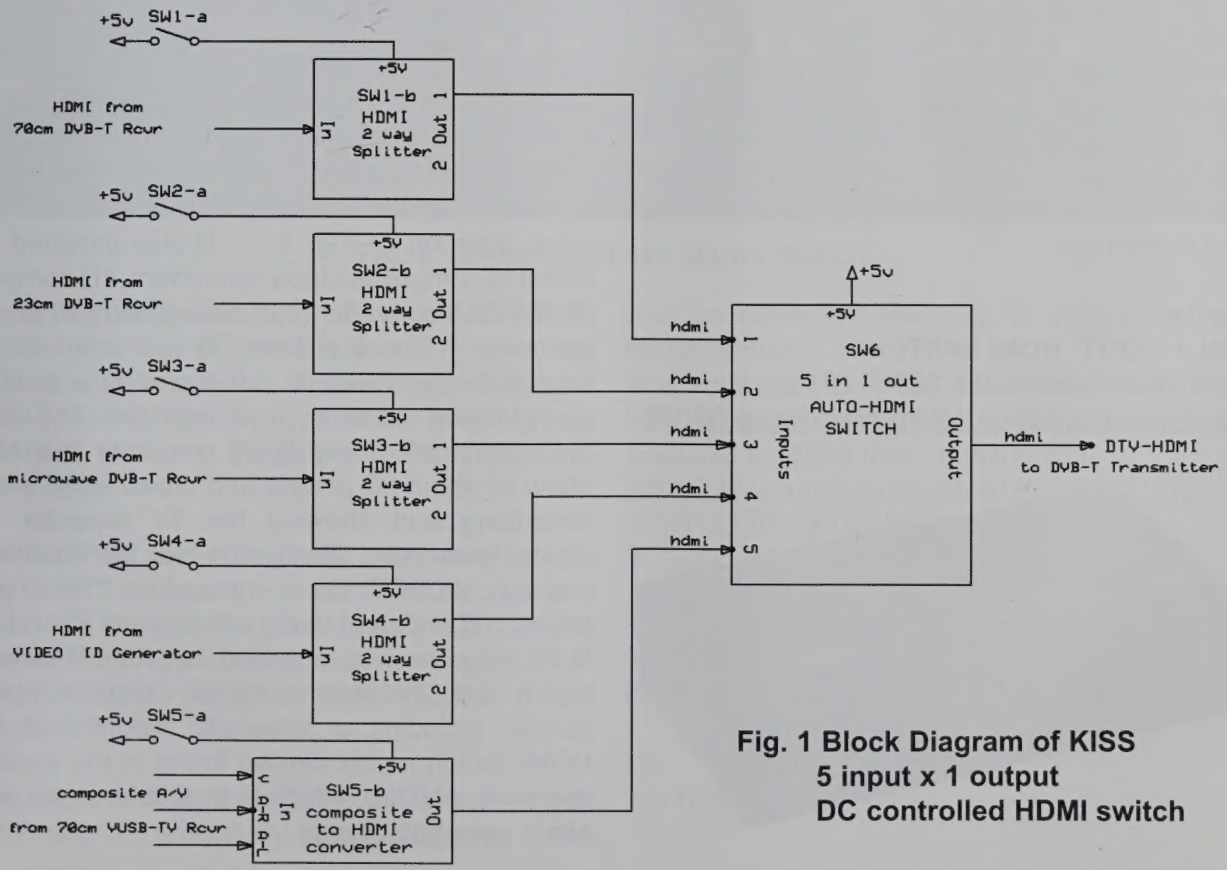

Fig. 1 Block Diagram of KISS 5 input x 1 output DC controlled HDMI switch

The key control requirements for this HDMI switch is to (1) Never allow more than one source to be active at any one time, (2) always switch off the active source, before switching on the next desired active source and (3) then do a master power reset for 2 seconds to all HDMI components, including the 5x1 active switch.

The example shown in Fig. 1 would be for a typical DTV repeater. It will work with any HDMI sources. Sources 1, 2 and 3 are shown from 70cm, 23cm and microwave, DVB-T receivers. Source 4 is the Video ID Generator to satisfy FCC identification requirements. This could be from a local TV camera, a DVD player running a continuously auto-looping DVD slide show or video show, or a computer playing an .mp4 file continuously. Source 5 shown is how to inject composite analog video and audio into the HDMI switch. This uses an inexpensive ($30), DC controlled Composite to HDMI converter.

After purchasing various, miscellaneous HDMI components on the internet to build my HDMI Switch Matrix, I found that they are not all equal, contrary to the advertising. I have been burned on several purchases, that either didn't perform as advertised, or worked but were not reliable and were prone to "glitching". The HDMI components that I did find to work well for me, are listed below and to the right:

Fig 2a:
5 IN x 1 OUT HDMI SWITCH:
Monoprice model 8203, $25
http://www.monoprice.com/product?p_id=82035

Fig 2b:
1 IN x 2 OUT HDMI SPLITTER:
Swees model SP27695-1, $16
https://www.amazon.com/Splitter-Amplifer-Support-Compatible-Blu-ray/dp/B01DY29REA

The really big, major drawback to my switch design, compared to broadcast studio switches, is the considerable time delay in accomplishing the switching. I measured it to be approximately 12 seconds. Very marginally acceptable for ham TV. Not acceptable at all for broadcast TV.

HDMI SWITCH MATRIX: The actual HDMI Switch Matrix, Fig. 3, which I designed and built for the Boulder, Colorado, W0BCR, TV repeater is a bit more complex than shown in the block diagram of Fig. 1. It also included (3) HDMI to composite video converters, (1) composite to HDMI converter, and a Raspberry Pi microcontroller. The Raspberry Pi was used as the source for the Video ID. It played in a continuously looping mode, an .mp4 video file. The video file I prepared on my Apple computer is a slide show of about 30 photos and power-point slides describing and showing the TV repeater, it's shack, tower, etc. Each slide had the repeater's call sign, W0BCR, super-imposed on it for ID purposes. The idea of using a Raspberry Pi and the R-Pi program was supplied by Ken Rawlings, KV5Y, and Don Nelson, N0YE. More complete details, including a schematic diagram of this HDMI switch matrix can be found in my application note, AN-30b, which is available on my web site: www.kh6htv.com

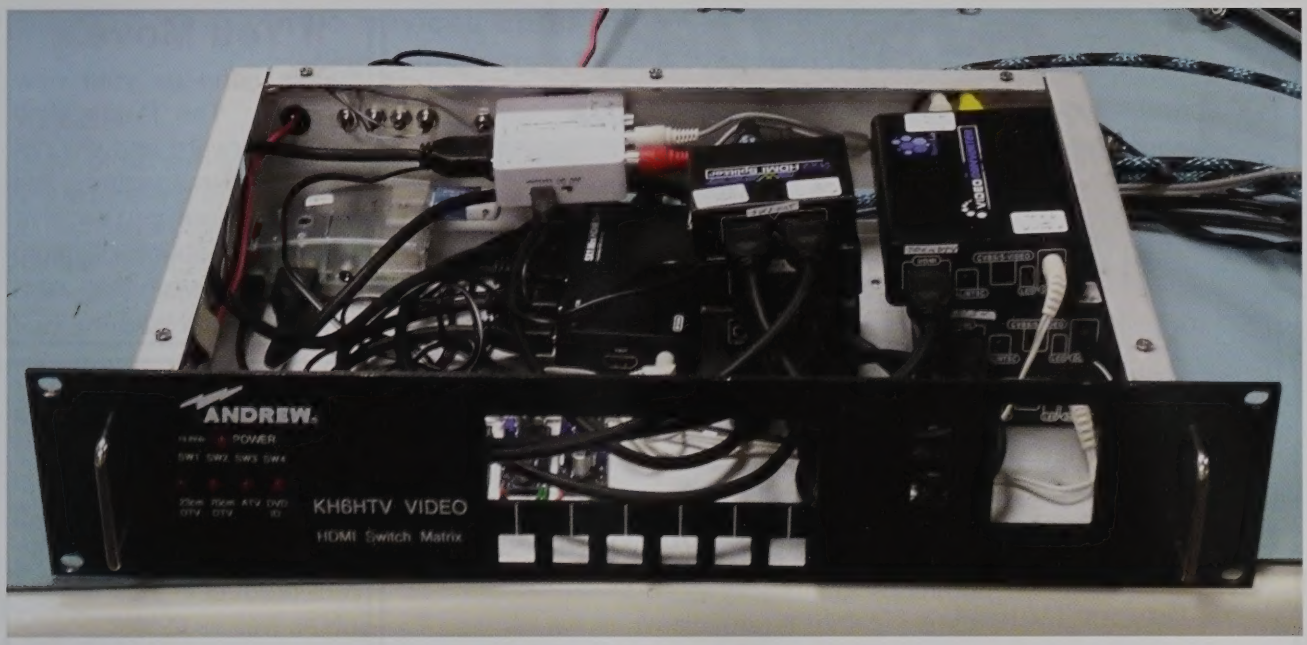

Fig. 3 W0BCR TV Repeater HDMI Switch Matrix

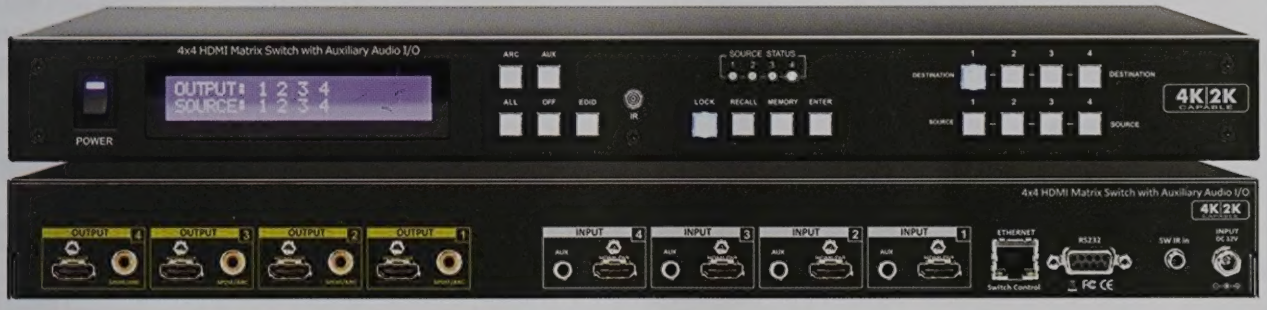

Fig. 4 Commercial 4x4 Matrix Switch

Since originally submitting this article to ATVQ, another Boulder, CO area, active DTV ham has just completed building a new, improved Quad DVB-T receiver for use by our local ARES group, BCARES, and also the Boulder Sheriff's department SWAT team.

Matt, K0DVB, has put together some very impressive DVB-T equipment. In his latest box, he also included a commercial HDMI switch matrix. The 8 input, HDMI Switch Matt used was made by A-NEUVIDEO and was their model HD-88L, It sold for about $1,150.

Matt reports that it switches between various HDMI sources essentially instantaneously. It can also be controlled remotely, in addition to front panel controls.

Matt says the HD-88L is now discontinued, but a less expensive, 4x4 HDMI switch, Fig. 4, is still available for $565 from Amazon.com
https://www.amazon.com/MATRIX-ROUTING-SWITCHER-EXTERNAL-BOOSTER/dp/B00XJZK1MU

If your local ham group's budget supports it, I would definitely recommend it over my cheap design with lots of undesirable time delay.

73,
Jim KH6HTV

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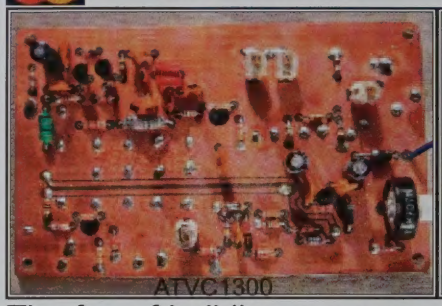
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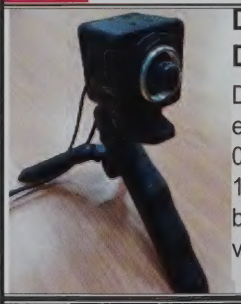

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HV-120 is a 1080p wide band DVB-T Ham TV receiver box . Outputs are HDMI & CVBS. Frequency range is 100-950 MHz & 1150-2650 MHz. 2-8 MHz bandwidths supported.

Two Novices Enter the DATV Arena - Elmerless

-Skip Youngberg, K1NKR & Fred Kemmerer, AB1OC

Genesis

Each of us strongly believes that Amateur Radio is a learning hobby, so when we were conducting a Technician class in June 2015 a coffee break naturally turned to a "what's next" discussion. Coincidentally, the QST with Jim Andrews' article had arrived in the mailbox that Saturday.

Our original thought was to try the existing Amateur Television technology and then, step-by-step, move up to the newer stuff-probably abandoning the assets from each earlier experiment as we went along—SSTV then EasyPAL on HF or over a local VHF link, followed by analog ATV on 70, 33, or 23 cm, and finally digital ATV.

The Decision

Skip had already received SSTV and EasyPAL imagery using software demodulators. Over the past few years he had tried SWLing those modes, but never had actually transmitted. (Probably mike—or rather image—fright.) Each was good—no complaints. But still imagery didn't satisfy that "ATV experimenter" need. Nevertheless, trying full-motion imagery was going to be largely driven by cost.

Analog ATV was going to present a decision challenge. The TV-736 for Skip's FT-736R was rare and expensive at $400-600 if one could be found at all. Plus, it only provided black and white operation, and would have been limited to the 1.2GHz band where Fred had no equipment. A 70 cm analog ATV starter station, per ads in *ATV-Quarterly*, looked like it was going to be a bit too costly to experiment with and then abandon. Equipment for US-standard ATSC would have been prohibitively expensive as well.

The June QST quoted $729 for a DVB-T modulator (modulator/exciter) and receiver. In the end, our full-up over-the-counter cost actually was $1279, plus Skip's expenditure of $229 for a camcorder and an HDMI TV/display to make up for his lack of a pre-existing techno-geek inventory. So, for the cost of a modest new rig we were each on the way to being on the air on DATV.

Pre-modeling and Set-up

Our stations are 13.6 km (8.4mi) apart, in a hilly and wooded area. Skip's early modeling using RadioMobile indicated that we could expect reliable communication (Figures 1 and 2). This early modeling used a few "maybe it's about this big" parameters. In the beginning of October, we had QSOd on 70 cm SSB and reduced power to try and verify those early RadioMobile predictions and get a feel for the path. Signals remained at S1-S5 when we reduced power to the 1-watt level[1]. Plus, the modeling supported reality and said things should work: that added to the incentive we already had! In late October we ordered a complement of equipment for each of us. Full disclosure, it took a series of e-mails between Fred and Jim KH6HTV to provide the help we needed as we were making our initial equipment choices and set-up so we were not entirely Elmerless.

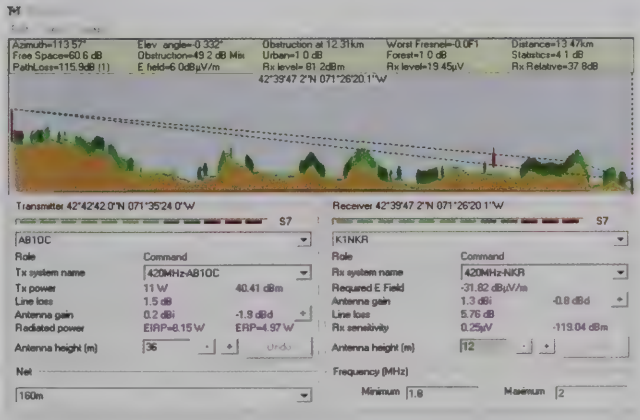

Figure 1. RadioMobile: AB1OC to K1NKR.

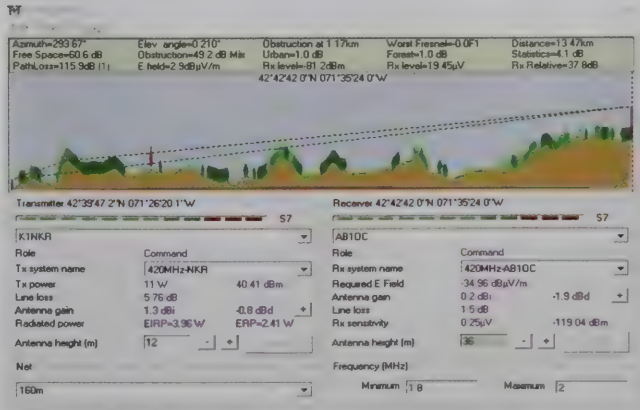

Figure 2. RadioMobile: K1NKR to AB1OC.

The last of the equipment arrived in late-November and we each commenced setting it up. We were both using HD Digital Camcorders as our primary video signal sources and 1080p monitors to display our received signals. The two stations were considerably different though. Early on, Fred decided to build a transceiver-like setup. He wanted to create a unit which was simple to use, just like the HF transceivers that are available today. Some of the key capabilities that he wanted to create included:

1. Real-time selection and switching between multiple HD video sources

2. Transmission of PC sourced video and graphics over the air[ii]

3. Preview and cueing of the next video transmission while receiving

4. Simultaneous display of both receive and pending transmit video

5. Built-in Transmit/Receive (T/R) switching with termination and protection of the TX power stage

6. Sequencing of T/R stages, including his tower mounted pre-amplifier system

7. Power and SWR monitoring with automatic trip on high SWR

8. An internal low-noise RF preamplifier to provide additional receive signal gain if needed

9. Touch screen graphical interface for configuration and operating the system

10. Recording of both sides of on-air video QSOs to an attached PC

To achieve these goals, he built a Raspberry Pi 2-based Linux controller and packaged all of the ATV components and video switching/conversion gear needed in a small rack mount enclosure (Figure 3). He wrote software so that any of the components in the system could communicate with any other over an Ethernet LAN and the transceiver could be networked to computers and other devices.

The small monitor on the right in Figure 4 is a touch screen display which Fred uses to control his ATV Transceiver system.

Figure 3. The AB1OC station.

Figure 4. The AB1OC camera, display, and controller.

Skip took the minimalist route. As soon as the shipment arrived, he set up his equipment on a drafting table and a desk in the basement room adjacent to the K1NKR ham shack (Figures 5 and 6).

He grabbed a TR relay from the junk box (a Tohtsu CX-120A from RF Parts) and dangled a PowerPole and a few pendant RF cable-and-connector sets from it, quickly connected it all to his existing 70 cm 11-element horizontal Yagi. (He later added a W6PQL sequencer borrowed from his stash of microwave gear.) Note the Elmer's Glue bottle holding up Skip's QSL card across the table from the camcorder (figure 6).

Figure 5. The K1NKR receiver.

Figure 6. The K1NKR transmitter.

As an interesting sidelight, Skip added one of the ATSC set-top converter boxes that were made available during the FCC's analog to digital conversion in 2009 to his system. In his November-December set-up he was using an NTSC-capable computer monitor and the entire receiver system gave him access to 46 local over-the-air ATSC program streams (on 16 RF channels) in addition to any remnant OTA commercial NTSC stations (there weren't any), plus Amateur analog and digital TV (there weren't any of those at the time, either). The monitor was replaced at Christmastime by an ATSC television, severely limiting his "monitoring station" status.

QSO

Skip got on the air on 8 December 2015. Following the reception of stray RF there in the basement, he temporarily moved his HV-110 receiver upstairs and connected it to the family TV "just to prove out the system" (Figure 7).

Live RF! It was as exciting as a Novice's first QSO. But now there needed to be someone on the other end of the link.

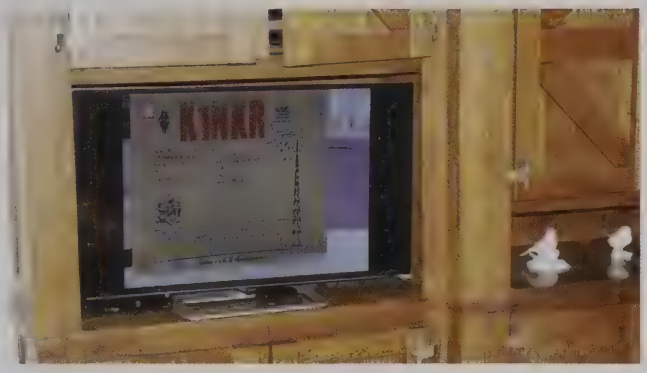

Figure 7. K1NKR, first "light"out of the shack.

Fred's first OTA experience was on 24 December 2105 and our first QSO occurred later that day.

Figure 8. First QSO. AB1OC at K1NKR.

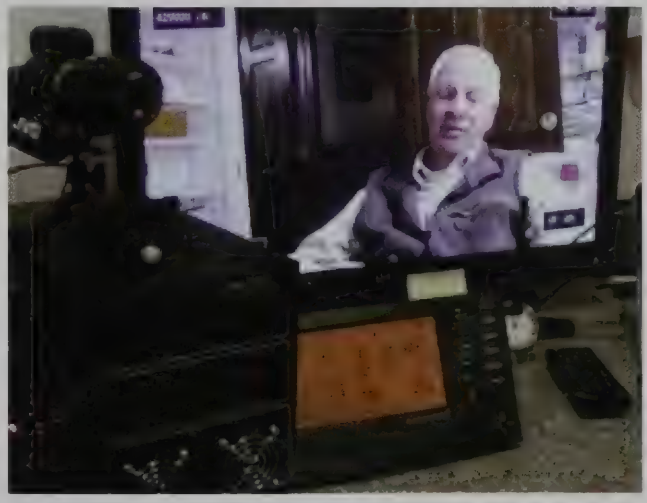

Figure 9. First QSO. K1NKR at AB1OC.

We've had a number of QSOs and so far, we've settled on 1280x1080 resolution, with H264 as our video encoding type, QPSK modulation, and Variable Bit Rate control. We're using 6 MHz bandwidth on 70 cm. Our original models and estimates were correct and we have very little rationale that would immediately drive us to other parameter selections to support our fairly unchallenging 13.6 km path. In fact, we've been able to send and receive images with motion at P5 using as little as 2 watts.

Next

Skip packaged his set-up in a surplus 14x14x10-inch shipping container for Field Day 2016 and Fred rolled his racked equipment onto his pick-up truck. On the 24th of June (exactly six months after "first QSO") we had a club-to-club field demonstration of DATV by "exporting" our home set-ups to the respective sites, which had a clear 7.6km path between them. With Fred's new M2 Systems 11-element Yagi at approximately 30 feet fed with 7/8" hardline and Skip's 5-element home-brew Yagi at 12 feet fed with RG-8M signals were P5 at 5 watts. (Figures 10 and 11)

Figure 10. N1FD/1, Hollis NH, at N1NC/1.

Figure 11. N1NC/1, Pepperell MA, , at N1FD/1.

We're still enjoying the learning process. More settings experiments are certainly on the horizon, including possibly trying other bands. (The HiDes equipment natively supports 33 cm transmit/receive, and accumulating a 23 cm capability isn't out of the question. Skip's even considering interfacing his equipment to his 3 cm station—but has no one to talk to!) Also, New England is blessed with a plethora of accessible mountain tops just begging for portable operation to see what DX we can establish.

As you can see from the map of known Amateur TV activity in New England (Figure 12), we're getting a little tired of looking at each other. The live demonstration between our clubs'[iii] Field Day sites in June generated some local interest but nothing has happened yet. We're also promoting the use of dongle-based receivers to entice locals to try some DATV SWLing and then join us on the air.

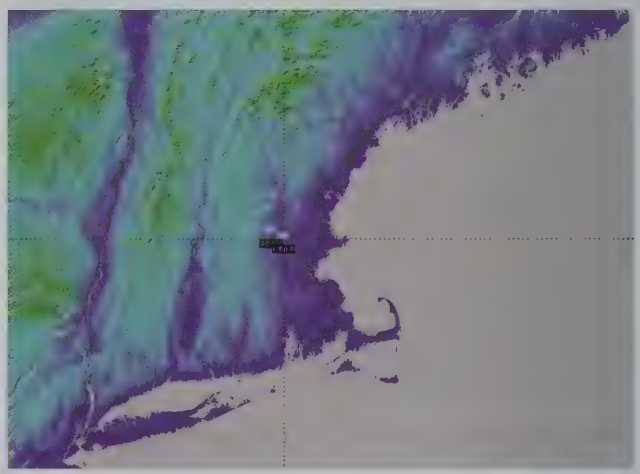

Figure 12. Known Amateur TV activity within 250km.

The Bottom Line

A few bits (pardon the pun) of closing comment from the newbies. This project was physically and electronically much easier than we expected. On the other hand, set-up was chancy. We didn't know what we didn't know, and therefore didn't know what questions to ask. But we worked out all the kinks in the equivalent of less than an afternoon. There's no reason others shouldn't join us. If we can do it, anyone can do it.

About the Authors

J.W. "Skip" Youngberg, K1NKR, of Tyngsboro MA, has been licensed since 1960. Although primarily a VHF/UHF/SHF operator, he has dabbled in many areas of the hobby. Now retired, he spent his US Air Force and civilian careers developing systems for communications, navigation, and intelligence. Skip can be reached at K1NKR@arrl.net.

Fred Kemmerer, AB1OC, of Hollis NH, has been licensed since 2011. Fred has contributed to the design and deployment of many IP data, video and wireless communications systems throughout his career. His Amateur Radio interests include station building, mobile HF, EME, contesting, software development, and helping new folks to become great hams. Fred can be reached at AB1OC@arrl.net.

References:

[i] Andrews, J., "DVBT: A Solution for ARES Television Opportunities," QST, June 2015, pp. 42-44.

[ii] This covered a HiDes HV-100 modulator, a KH6HTV 70-4B driver amplifier, a KH6HTV 70-8B power amplifier, and a HiDes HV-110 receiver.

[iii] RadioMobile is a handy path analysis program. See http://www.cplus.org/rmw/english1.html. We used a little bit of "Kentucky windage" to account for signal parameters that we didn't know how RadioMobile handled. What we didn't account for was the difference in bandwidth between voice and TV. Things were fine, even at 2 watts, during our winter tests but when the foliage returned we were at or below picture thresholds at 11 watts.

[iv] Fred is us using an M2 Systems Yagi with 21 elements and a 16' boom at 125 ft. His system uses tower mounted low-noise preamps from ARR and is fed with 1-7/8" hardline. Skip's antenna is a Cushcraft 19-element Yagi fed with about 80 feet of 9913.

[v] Fred included an HDMI Video Switch from Gefen (www.gefen.com/kvm/gtb-hd4k2k-444.jsp?prod_id=11452).

[vi] Fred's club is the Nashua Area Radio Club, N1FD (www.N1FD.org) and Skip's is the Nashoba Valley Amateur Radio Club (www.N1NC.org). The sites were in Hollis, New Hampshire, and Pepperell, Massachusetts—a mere 7.6 km apart.

73, Skip K1NKR & Fred AB1OC

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TV-AMATEUR 182-translations

Editorial (AGAF president Uwe Kraus, DJ8DW)

This year´s HAMRADIO fair in Friedrichshafen was a fine success for AGAF, we had many interested viewers at our stand in hall A1.

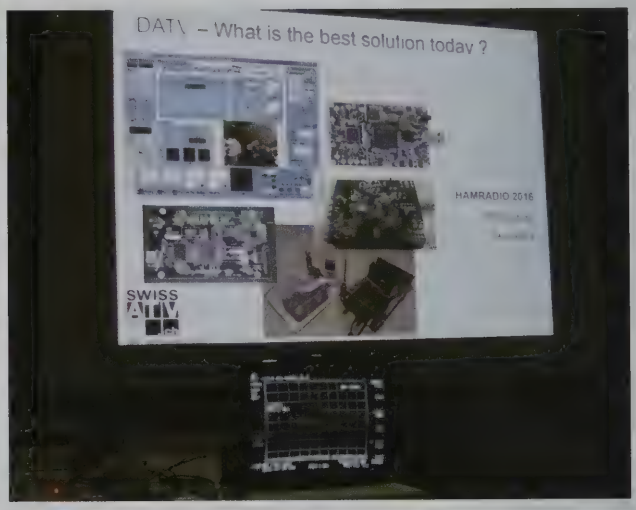
There were Willi DC5QC with his son, Klaus DL4KCK, Rudolf DJ3DY, and Uwe DJ8DW. Willi and Rudolf demonstrated their GMSK-DATV TX each and Klaus presented DATV recordings from his laptop on a beamer screen.

Like every year since 2001 Uwe showed live QPSK-DATV camera video and DVD playback alternately from his hotel at the Pfaender mountain (high above the eastern bank of Lake Constance in OE) on 23 cm, remotely controlled by DTMF. The aerials on the fair hall roof were built up again by DARC chapter Friedrichshafen. Because of bad wheather DC5QC was only able to transmit GMSK-DATV mobile from the parking ground nearby. Received DATV video was relayed on 2,4 GHz to the Munich ATV group stand in hall A1, from there it was transmitted on 70 cm in RB-DATV (DVB-T, 2 MHz rf bandwidth).

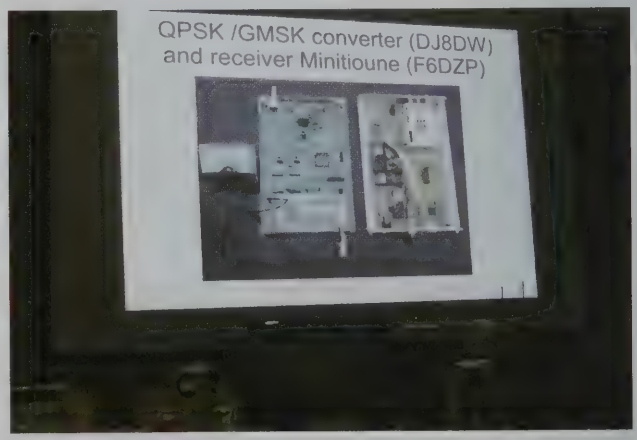
The Digital-ATV lectures on Friday from 12 to 16 had an international audience of more than 30 listeners:

12:00 Introduction by Uwe E. Kraus, DJ8DW, AGAF e.V.

12:05 DATV - What is the best solution today? Michel Burnand, HB9DUG



12:30 UK ATV and RB-Update (in English presented by DJ8DW as stand-in) Noel Matthews, G8GTZ



13:00 HAMNET Extension in Berlin and Interconnection to the ATV-Infrastructure (cancelled, Jörg Hedtmann, DF3EI, stayed at home in Berlin with back problem)

13:30 Coffee break

13:45 Construction and exploitation of a complete

DVB-T Station by Hans-Karl Sturm, HB9CSU

14:15 Power Amplifiers for DATV (cancelled, Dirk Fischer, DK2FD, had to leave before to his flooded firm at home)

14:45 Experiences with DATV in GMSK on the 70cm - Band Rudolf Pfeiffer, DJ3DY, and Willi Pieper, DC5QC

15:15 Q+A, comments and conclusions.

In 2017 the lectures will be organized by Pierre-Andre Probst, HB9AZN.

AGAF General Meeting

At the AGAF general meeting on Saturday we elected a rejuvenated committee and a forward-looking charter.

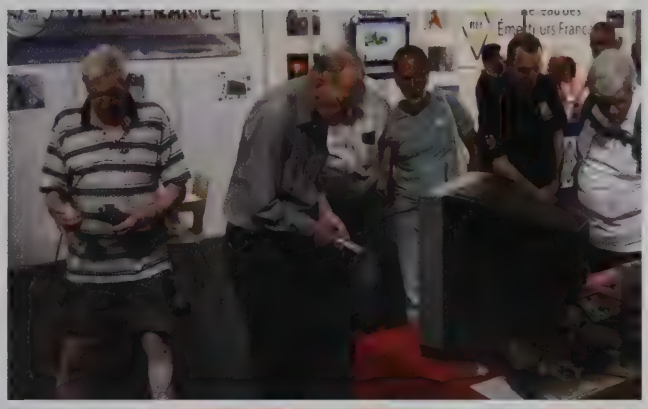
New chairman is Joerg Hedtmann, DF3EI, from Berlin. New treasurer instead of a manager is Thomas Krahl, DC7YS, from Berlin. New reporter and chief editor is Klaus Kramer, DL4KCK, from Cologne. The minutes of this meeting by Jens, DH6BB, (as well as some pictures) are found in TV-AMATEUR 182.

Because of severe roof damages across the whole village after a tornado in the Netherlands I had to depart for home immediately. The new AGAF committee will have to organize and modernize the club in many ways and to focus on new communication methods.

TV AMATEUR 182 Front page headlines:

New AGAF Committee, TV report DC7YS, last Ham TV contact of ISS mission 47, result of IATV contest June 2016, AR balloon reflection, HAMPADS: portable Ham TV receiver, ATV history in Germany: home made AM-ATV TX from 1968 by DJ8DW.

Translations: Klaus Kramer, DL4KCK
www.agaf.de



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ESA-Astronaut Tim Peake, KG5BVI, im Columbus-Modul der ISS
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ATV-Kontest Juni 2016 • Ballonflug – eine Nachbetrachtung •
HAMPADS: tragbare Empfangsantenne für HamTV • ATV-
Historie in DL: Eigenbau-AM-ATV-Sender aus dem Jahr 1968

New Boulder, CO ATV & DTV Repeater

-Jim Andrews, KH6HTV www.kh6htv.com

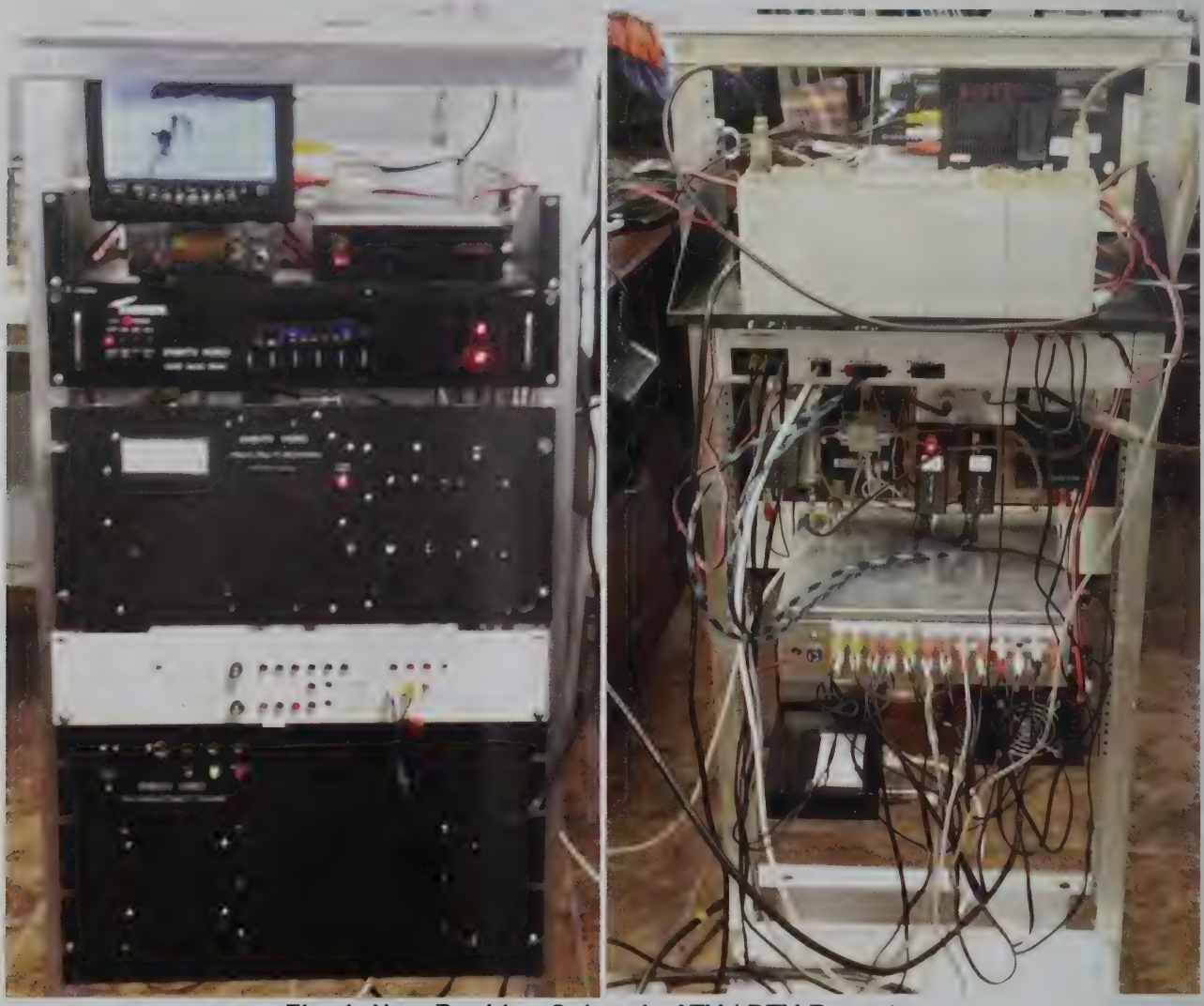


Fig. 1 New Boulder, Colorado ATV / DTV Repeater

Boulder has had an analog, NTSC, VUSB-TV repeater since 1993 [1]. It was designed, built, modified, and maintained since it's origin by Jim Andrews, KH6HTV (formerly WA0NHD).

The most recent analog design dates from 1997 with some modifications / upgrades in 2006. This most current revision is a major upgrade adding digital television (DTV) capability to the repeater, both for receive and transmit. The new repeater was installed and become operational on 7 Sept. 2016.

The major features of this new repeater are:

1. Dual-band receive capability (23cm & 70cm)
2. Two analog receive modes (23cm FM-TV & 70cm VUSB-TV)
3. DVB-T receive mode on both bands
4. 70cm transmit in either analog NTSC,VUSB), or digital (DVB-T) modes
5. Beacon mode

The selection of the operating mode is done by a control operator using DTMF (touch tones) on a separate RF control channel. The repeater's receive frequencies are: DTV Receive = 1243MHz & 441MHz, ATV Receive = 1247MHz (FM) & 439.25MHz (VUSB). The transmit frequencies are: DTV = 423MHz (DVB-T) & ATV = 421.25MHz (VUSB). The control frequency is unpublished and kept confidential.

BLOCK DIAGRAM: The block diagram of the new DTV / ATV repeater is shown in Fig. 2. A detailed study of this diagram will reveal the key, important details of the overall system design and it's parameters. Key elements are: 1. four separate TV receivers, 2. dual-mode transmitter, 3. Arduino micro-computer for repeater control and 4. Raspberry-Pi micro-computer for generating hi-def (1080P) video for ID and Beacon purposes.

Elements of the original ATV repeater were retained and reused in this new repeater. They included: antennas and coax feed-lines, tri-plexer, 70cm band-pass filters, 70cm & 23cm pre-amps, 70cm VUSB receiver, 70cm VUSB modulator, 2m FM control receiver,
DTMF tone decoder, analog A/V switch, 15kHz horizontal sync detector, audio squelch, A/V line drivers (VDAs) and 13.8Vdc power supply.
New items added included: KH6HTV Video, model 23-7, 23cm Down-Converter & model 23-5 70MHz IF & FM-TV Demodulator; Hi-Des, model HV-120A, DVB-T receivers; Hi-Des model HV-100EH, DVB-T modulator; KH6HTV Video, model 70-12C, 70cm RF Linear Power Amplifier; custom built HDMI Switch Matrix; Arduino micro-computer and Raspberry-Pi micro-computer. Plus many 100s of hours of design and labor by both Jim Andrews, KH6HTV, and Don Nelson, N0YE.

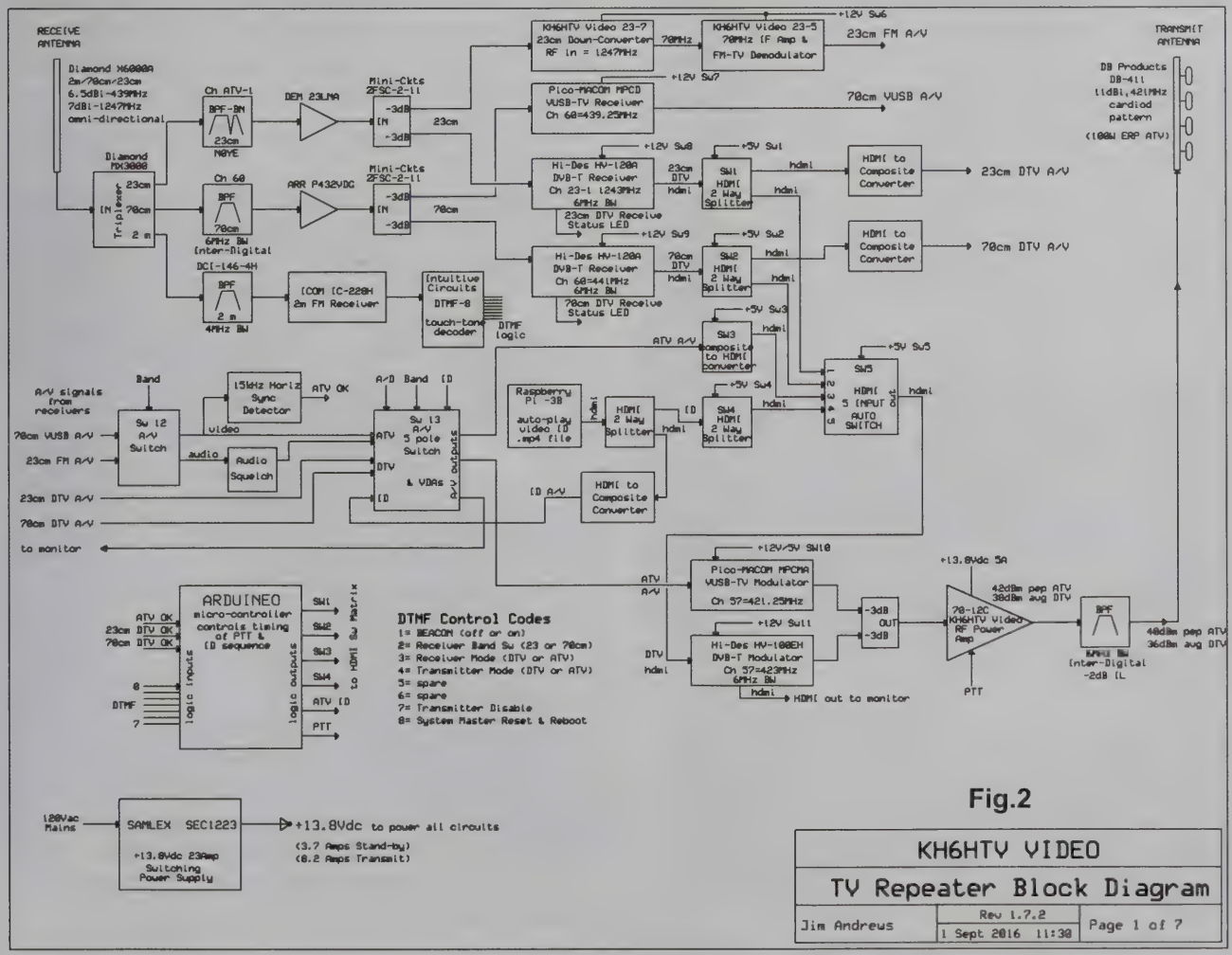


Fig.2

Complete details about this new repeater can be found in reference [2]. AN-31 contains complete schematic diagrams, photos, technical descriptions of all major components, performance data, etc. It also includes photos of the repeater site and coverage map. Some additional details about the Boulder TV repeater are also found on www.qrz.com by entering the repeater's call sign, W0BCR.

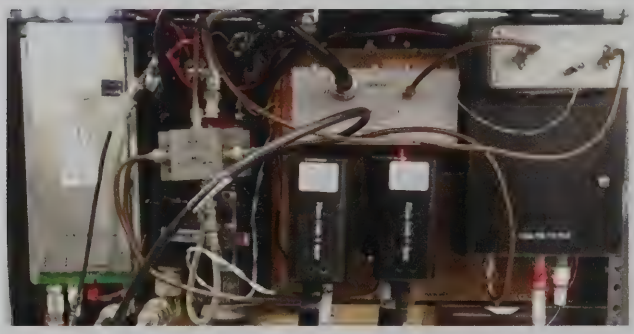


Fig. 3 TV Repeater Receivers --- all mounted on 19" panel, rear view

TV RECEIVERS: All of the four TV receivers along with their associated rf circuitry are mounted on a single 19" rack panel, Fig. 3. The Hi-Des HV-120A receivers were modified slightly to pick off a *Valid TV* logic signal from the Red/Green status LED [3]. This logic signal was used by the controller to key the PTT line of the transmitter.

Control circuits turn off the DC power to unused receivers. A special band-pass, band-reject filter was required for 23cm. This was required to put a >60dB notch on a new, powerful, FAA, Denver airport radar operating in the middle of the 23cm band (1265-1270MHz). Don, N0YE, found a key 1.5GHz filter in some surplus microwave equipment which he salvaged and modified for our purposes. Without Don's filter our 23cm band would have been useless to us.

Tests were run to determine the actual receiver sensitivities of the repeater. For the DTV receivers, this is the digital threshold at which the receiver turns on it's video and also keys the repeater. The DVB-T, QPSK sensitivity was about -94dBm on 23cm and -92dBm on 70cm.

For the ATV receivers, the sensitivity measured was the level at which the 15.75KHZ horiz. sync detector keyed up the TV repeater. For 23cm FM-TV, the sensitivity was about -100dBm. For 70cm VUSB-TV, the sensitivity was -90dBm. At repeater key up threshold the quality of an ATV signal as viewed on an NTSC studio monitor was P1 (FM) or P2+ (VUSB). Higher signal levels gave the following P results. 70cm VUSB-TV: P3 = -90dBm, P4 = -83dBm & P5 = -65dBm. 23cm FM-TV: P1 = -100dBm, P2 = -97dBm, P3 = -92dBm, P4 = -87dBm & P5 = -75dBm. The superiority of FM vs VUSB is obvious from these measurements !

Picture quality is always P5 (perfect) for DTV. Only at digital threshold is some pixelization or frame freezing seen. The digital threshold "cliff" is typically only about 1dB wide. Thus, we now understand the technical superiority in receiver sensitivity of DVB-T over the older analog systems. For a P5 picture, the repeater requires -93dBm (DVB-T, QPSK) vs. -75dBm (FM-TV), vs. -65dBm (VUSB-TV). Very dramatic differences indeed !

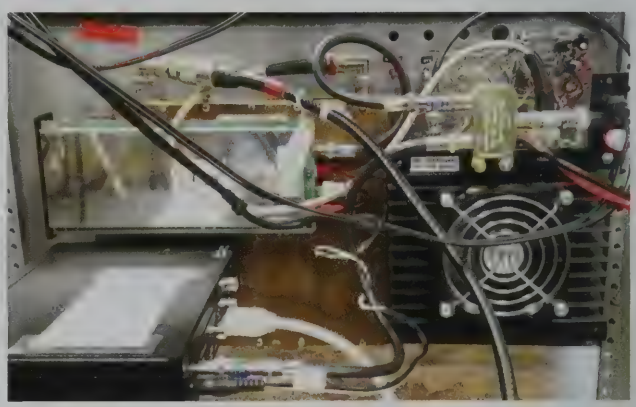


Fig. 4 TV Repeater, dual-mode, 70cm, Transmitter -- mounted on 19" rack panel, rear view

ATV / DTV -- TV TRANSMITTER:

All of the repeater's transmitter components are mounted on a single 19" rack panel, Fig. 4. The transmitter basically consists of two modulators feeding a 3dB power combiner and then an RF linear power amplifier, followed by a band-pass channel filter.

The selection of either operating as an analog (ATV) or digital (DTV) transmitter is determined simply by powering up the dc voltage to the appropriate modulator. This is done via a logic control line labeled "*TX-AD*" which comes from the system controller. A Pico-Macom, model MPCMA, is used as the analog, VUSB-TV, modulator. It is the silver colored module in the left center of the above photo. It produces extremely pure VUSB-TV modulation with no out of channel energy. The digital modulator is a Hi-Des model HV-100EH producing, hi-def (1080P), DVB-T QPSK modulation.

Fig. 5b TV Transmitter output spectrum, DTV (DVB-T) mode, 10 dB/div & 2 MHz/div.

The output powers from the two modulators are quite weak at less than 1 milli-watt (0dBm). They must be amplified to useful power levels in the watt range. To preserve the spectral purity of the modulator signals, the amplifier used must be extremely linear. Any non-linearity will result in the growth of undesired sidebands out of the assigned, 6 MHz (420-426MHz) channel. The amplifier used is a KH6HTV Video model 70-12C. The amplifier is the black module with the cooling fins and fan in the lower right side of the photo. Detailed specs. can be found on the web site: www.kh6htv.com Key specs. are 53dB gain, +42dBm pep (ATV) or +38dBm avg (DTV). It operates on +13.8Vdc and draws about 5 Amps. The amplifier comes with a built-in PTT (Push-To-Transmit) circuit. Grounding the PTT line turns on the amplifier. The amplifier's on/off ratio is 113dB. PTT logic control for the amplifier comes from the system controller.

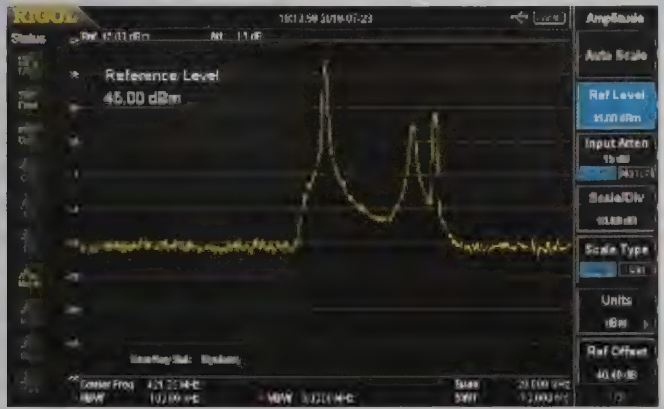


Fig. 5a TV Transmitter's output spectrum ATV (UVSB) mode, 10dB/div & 2MHz/div.

The final component in the transmitter is a 6MHz bandwidth, channel filter for 420-426MHz to remove any out of band emissions. We reused our old Spectrum International inter-digital, BPF. It has about -2dB of insertion loss, but very sharp cut-off skirts. An identical Spectrum International BPF was also used for the 70cm receiver (438-444MHz). The resultant output spectrums were very clean, Fig. 5. Any lower sideband energy on the ATV signal was well below the spectrum analyzer's noise level. The shoulder break-points on the DTV signal were -32dB down and then with very steep skirts beyond the channel edges. The resultant output power to the antenna was +40dBm (10 Watts) PEP for the ATV signal and +36dBm (4 Watts) rms average for the DTV signal.

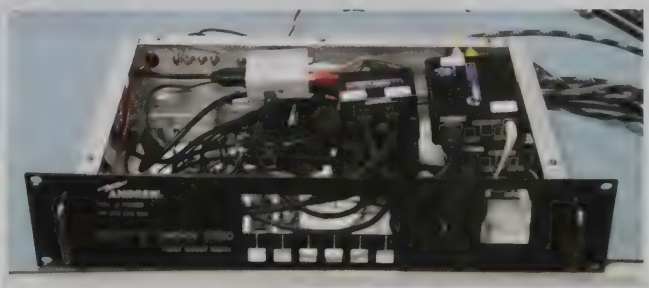


Fig. 6 HDMI Switch Matrix

HDMI SWITCH MATRIX:

A key component required for a digital TV repeater which uses more than a single video source is a means of switching between various HDMI sources. A simple DTV repeater was discussed in reference [3]. Don, N0YE, has built such a DTV repeater and it was extremely simple to build.

One simply took the HDMI output from a Hi-Des receiver and plugged it into the HDMI input of a Hi-Des modulator. The Red/Green receiver status LED was used to key the PTT line of the rf power amplifier and "voila" you have a functioning DTV repeater. To add other video sources, such as additional receivers, local camera, video ID generator, computer, etc. really complicates the issue because a means now must be found to remotely switch among these various HDMI sources.

I studied this problem and came up with a low cost, working solution, Fig. 6.. The basic concept was to use 1 in / 2 out HDMI splitters as dc controlled switches feeding an auto scanning 5 in / 1 out HDMI switch. Additional details are found in AN-30, reference [4]. For operating the repeater as an ATV transmitter, analog, composite video & audio was also required. Thus, for the various hi-def, HDMI, digital sources, HDMI to Composite converter modules were included in the HDMI Switch Matrix design. Likewise for retransmitting incoming analog video & audio as digital, a Composite to HDMI converter module was included.

VIDEO ID GENERATOR:

To meet FCC identification requirements, and also to have a source of video for operation in the BEACON mode, some form of video ID was required. The original 1993 ATV repeater used a simple ID generator, from Elktronics. My original idea was to use a high-definition (1080P), Blu-Ray, DVD player as the source of ID video. An auto-play, auto-repeat disc would be used to provide a continuous stream of hi-def HDMI video. The disc would have the repeater's call sign super-imposed on each frame of video.

Midway through the new repeater project, Don, N0YE, convinced me to instead use a Raspberry-Pi microcomputer instead of the Blu-Ray DVD player. He felt that in the long term, it would be more reliable and it would eliminate a mechanical device from the system. The Raspberry-Pi is an amazingly powerful computer for only $40.

It provides an HDMI output for driving a display monitor. Don and Ken Rawlings, KV5Y, came up with a R-Pi program that would read from a USB flash drive, memory stick an .mp4 file and then play it continuously. "Voila" it worked ! I thus elected to use it instead of the Blu-Ray player. The Raspberry Pi was installed in the HDMI switch matrix enclosure.

I prepared on my Apple computer, a hi-def (1080P), ID video slide show of about 30 photos and power point slides that give detailed information about the TV repeater and showed photos of the repeater and it's site. I put the repeater's call sign, W0BCR, on each and every video frame. This is the .mp4 file played continuously on the R-Pi computer.

REPEATER CONTROLLER:

The heart of the new TV repeater is it's Controller, Fig. 7. I reused my original 1997, WA0NHD-TV repeater controller rack mount enclosure and many of it's circuits. The Elktronics video ID generator board and the Morse code ID generator boards were removed. The DTMF decoder and the analog circuitry perfboard were retained. New items added include A/V relays and an Arduino micro-computer and a handful of transistors, etc. All of the analog and digital inputs and outputs to the Controller are on the rear panel and are via RCA jacks. A bank of LEDs are provided on the front panel to indicate the status of the repeater. They display the DTMF decoder states along with indictors of valid input rf tv signals and the PTT status. The Arduino is the small, blue, pc board in the lower right of the photo. The DTMF decoder is the green, pc board in the lower left of the photo.

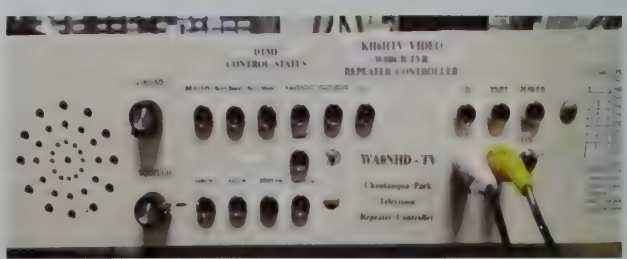


Fig. 7a TV Repeater Controller Front Panel

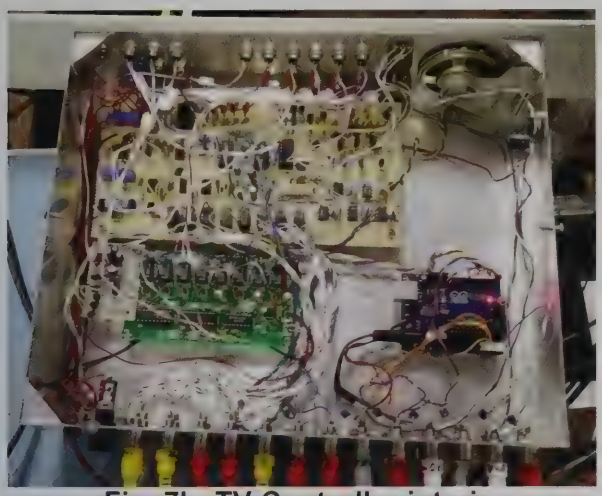


Fig. 7b TV Controller interior

ARDUINO:

A $25 Arduino - UNO (www.arduino.cc) microcomputer was used as the system controller. It reads the state of the DTMF decoder to set the receive and transmit configuration of the repeater. It then sets the HDMI Switch Matrix switches accordingly. It senses when a Valid TV signal is present and then keys the transmitter via the PTT line. If the BEACON mode is set, it turns on the transmitter continuously with the ID generator video being broadcast. In normal repeat mode, it turns on the ID generator for a brief interval at the termination of an incoming rf-tv signal. To meet FCC requirements, it also has a 10 minute ID timer. The computer code for the Arduino was written by Don Nelson, N0YE. It contains about 600 lines of code, including comments.

REPEATER COVERAGE AREA:

Fig. 8 shows the coverage area of the new repeater [5]. The red area is within the FCC Grade A contour and corresponds to P5 for analog, ATV. The blue area is within the FCC Grade B contour and corresponds to P4 for ATV. The probability is very good for excellent analog or digital reception within these areas. The gray area is the fringe area with either P5 digital DTV or P2 to P3 analog ATV. The probability of reception in the gray area is marginal at best and typically will require a serious station with a large Yagi antenna on a high tower. Outside of the gray area, reception is impossible. An exhaustive mobile field survey has been performed through out most all of the shaded areas shown on the map. Detailed field strength measurements were taken at over 150 different locations. The farthest confirmed DTV distance was 34 miles to the Denver International Airport. The survey confirmed the accuracy of the coverage map. More detailed maps and additional information are found in reference [5].

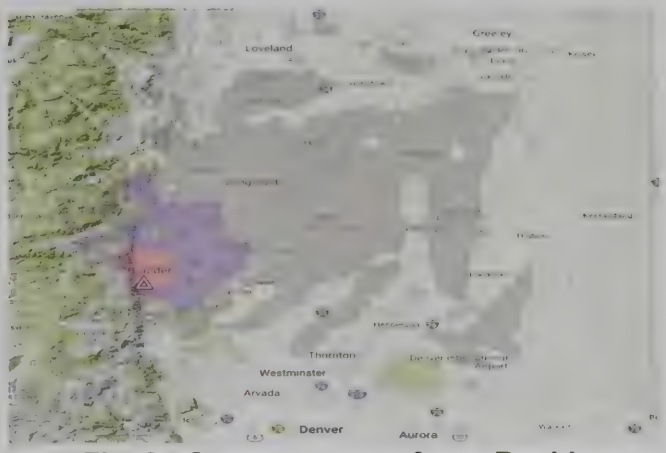


Fig. 8 Coverage area of new Boulder ATV/DTV Repeater Red = Grade A contour, Blue = Grade B contour Grey = fringe area P2-P3 ATV and possible DTV

REFERENCES:

1. "W0BCR Boulder, Colorado TV Repeater", Jim Andrews, KH6HTV, ATV Quarterly, Winter, 2013, pp 28-32
2. "Digital & Analog TV Repeater", Jim Andrews, KH6HTV Video Application Note, AN-31, Sept. 2016, 24 pages
3. "DVB-T Television Repeater", Jim Andrews, KH6HTV Video Application Note, AN-23, June, 2015
4. "An HDMI Switch for a Digital TV Repeater", Jim Andrews, KH6HTV Video Application Note, AN-30b, Aug. 2016
5. "Boulder, CO - DTV/ATV Repeater Coverage", Jim Andrews, KH6HTV Video Application Note, AN-32, Sept. 2016.

note: these application notes are available to be downloaded as .pdf files from the web site: www.kh6htv.com 73, Jim KH6HTV

ATN-CA Summer Bar-B-Que Meeting 2016

-Tom Board WB6HYH

This summer's Bar-B-Que meeting was on August 6th at the home of Tom and Chris Board in Rancho Cucamonga. However, Chris could not be here because she was still in Florida vacationing with her grandson. Luckily my son Ryan and his wife Tracy are temporarily living with us and were a great help in getting everything set up for the day. The ladies that were in attendance, Julie Haltman - KJ6FYY, Linda Smith, Barbara Miller and Irene Ryan, were a terrific help in getting all the food prepared and set up. Thank you. That made my job as Grill Master a breeze!

All the other food that was brought by everyone made this a real feast. Thank you everyone for your contribution. It was greatly enjoyed by everyone.

The weather that day may have been slightly warm, but it was great for a Bar-B-Que. Everyone had a good time socializing and talking about everything from politics to ham radio and specifically *Amateur Television*. It seems like whenever the ATN membership gets together there are always plenty of interesting topics being discussed. I for one always gain more insight and knowledge about ATV at each of these get-togethers. If you have never attended an ATN Bar-B-Que, or it has been a long time, I encourage you to attend the next one. Our meetings are always open to anyone interested in amateur radio and wanting to learn more about fast scan amateur television.

One very interesting part of the "meeting" was KC6JPG – Roland's demonstration of his Digital ATV system. By the utilization of Wi-Fi, the internet and his high definition cameras and equipment, Roland is able to provide the activities and transmissions on the ATN repeater system to virtually anyone around the world with internet access. Roland has put together a very compact portable system that works well. He also utilizes this setup, from time to time, at the San Bernardino Microwave Society's monthly meetings.

This enables hams from around the world to interact with these very interesting meetings. Thank you Roland for sharing your knowledge of Digital ATV with us and demonstrating your fantastic set-up.

Roland showing his new KH6HTV Amp

Another very interesting part of the meeting is the repeater site updates. The ATN system is continually in a state of improvement and expansion. It is always exciting to hear from each of the repeater trustees about what improvements that have been made to each of the repeater sites. I personally like to hear about who did what and why it was done. I think it is this type of information that keeps the members interested and excited in utilizing the great system that we have.

A special thanks to Mike Collis WA6SVT who is the force that keeps our organization and great repeater system functioning so well.

Then there is always the meeting after the meeting! This is the few people that hang around after all the food has been put away and most everyone has headed back home. Usually this is when a piece of equipment needs to be looked at, worked on or discussed. The subject this year was "*why my 2.4 GHz transmitter was not getting into the Santiago Peak repeater*".

Mike Collis WA6SVT, had checked out the transmitter, Norm Hill KD6OMV, had checked out the feed line, antenna system and correct frequency output. I had climbed the tower and did not think there was anything interfering with the line of site to the repeater. So what was the problem? After much discussion and no one coming up with an answer, everyone left except for Mike.

I think he was as determined as I was to solve this issue. We went up on the roof and Mike was surprised that he could actually see Santiago Peak without even going up on the tower. No trees in the way, just a clear shot to the peak. I mentioned to Mike I had another Conifer type dish antenna. So, we quickly slapped it on the side of the tower, disconnected the feed line from the old antenna and connected it to this new antenna. We went back into the shack and fired up the transmitter. Low and behold a good P4 picture. This was then followed up, at a later date, with the removal of almost 30 feet of excess transmission line cable. I now have a great P5 picture into the repeater. This is one reason why it is beneficial to host the summer Bar-B-Que at your home.

I have to say that it is a little bit of work to host the ATN Summer Bar-B-Ques. However, the enjoyment, fellowship, information and benefits outweigh the little bit of work involved. Thanks for allowing me to be your host.

73, Tom WB6HYH

2016 DATV QSO Party

-Don Hill KE6BXT

ATVers from Australia, USA and other countries were geared up for this year's World Digital QSO Party. Hosted by Peter Cossins VK3BFG, the event kicked off at 8pm (AEST) on Friday August 30.

It started with the Australian stations in the Melbourn area via the VK3RTV repeater on 446.5 MHz DVB-T mode and also to the world via the BATC website. Mick Ampt VK3CH showed his portable ATV set-up and members of Melbourne's EMDRC showed off their new DATV facility.

The VK4RKC Brisbane DATV repeater was then relayed via an anchor to VK3RTV and the world via the BATC site. A few stations used Skype calls to Peter VK3BFG and he patched them in to VK3RTV.

On Saturday August 31 (AEST) morning and afternoon will link up with ATCO and the W6ATN Southern California network and W7ATN Arizona via the local anchor Don Hill KE6BXT.

All US stations worked through the California & Arizona ATV networks (ATN-CA & ATN-AZ) and Amateur Television Central Ohio (ATCO) directly or Skype to one of the anchors. Don KE6BXT was the anchor for ATN-CA and ATN-AZ and Art WA6RMC for ATCO. Art connected first to stream the Columbus Ohio area stations to Peter VK3BFG for distribution through VK3RTV followed by Don KE6BXT for the western USA.

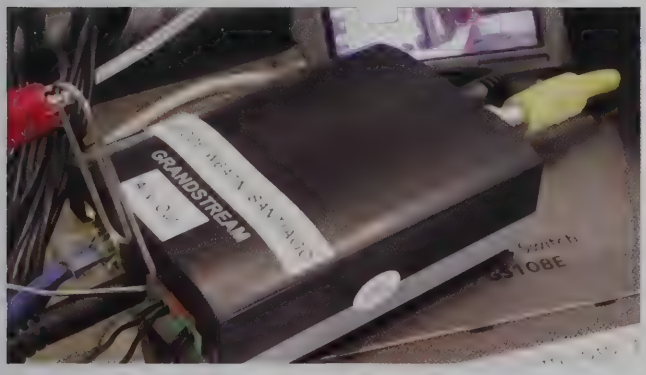
The event truly brings together those who are actively involved or have an interest in the ATV visual medium.

73, Don KE6BXT

Linking ATV Repeaters across state lines

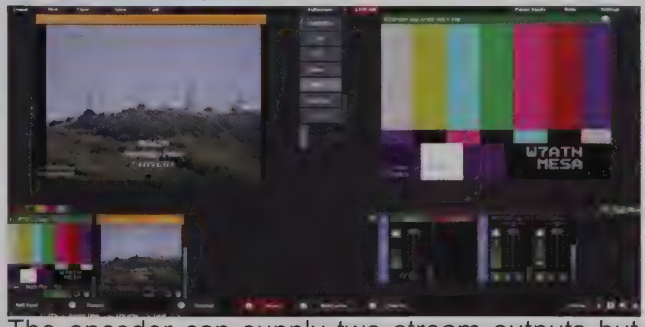
-Mike Collis WA6SVT

The picture above shows the output of Santiago Peak, California repeater on the left and Mesa, Arizona repeater on the right. The video is NTSC. FM Microwave links interconnect six repeaters in California and one in Nevada. Arizona has three repeaters linked the same way and a forth repeater is in process of linking. Until we finish our in process microwave linking between the two systems, we are using IP video linking. Rather than tie up a computer or two at each end, we use two Grandstream GXV3500 boxes (four in all).



Each standalone encoder/decoder box can be set up for either mode but not at the same time. A BNC connector takes standard NTSC or PAL (selectable) stereo two channel analog audio, RS-485 channel and an alarm I/O and provides an h.264 compressed stream with up to 2MB bandwidth with about 3 seconds latency at the 2 MB rate. We use a pair at each end for transceive.

It is best to a have static IP address but if you only have dynamic, set your router up to assign a static IP to the Grandstream box set up as the transmitter. Currently we are experimenting with signaling to allow us to key the receive boxes video output via an external relay box, this allows you to then feed the output of the relay box to your existing analog ATV controller's A/V input. The transmit side signaling uses the analog repeater controller logic to only encode video when repeater user inputs are active. This allows automatic operation between repeaters anywhere. The Grandstream units are fully compatible with the vMix program that is popular with the ATV community and with the VLC media player allowing use with a computer.



The encoder can supply two stream outputs but the decoder is one stream at a time. Price is less than $100 on ebay.

73, Mike WA6SVT

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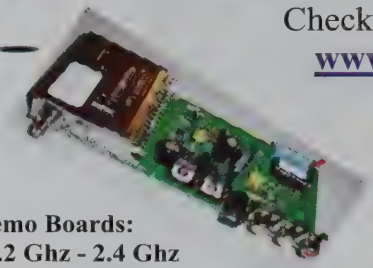

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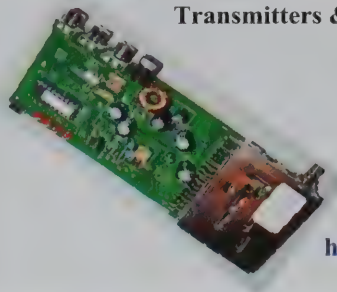

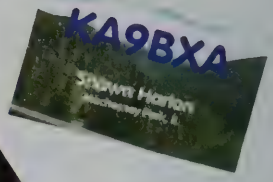

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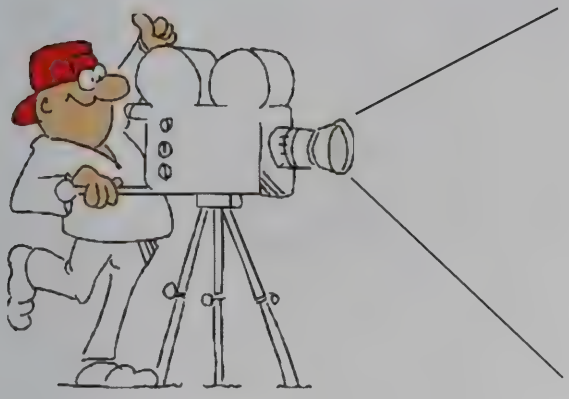

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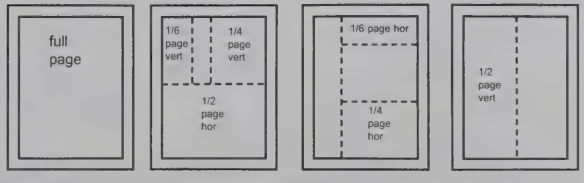

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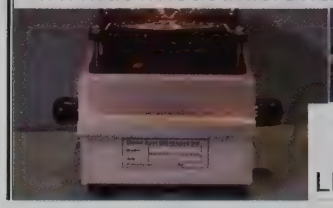

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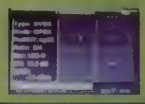

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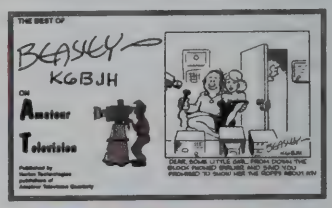

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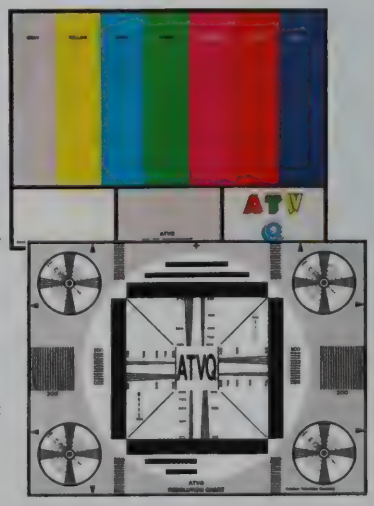

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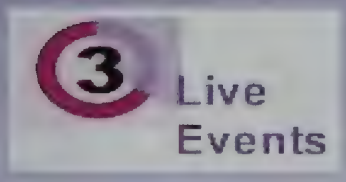

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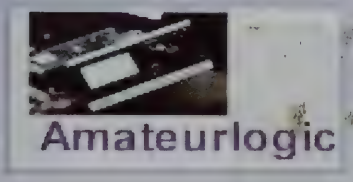

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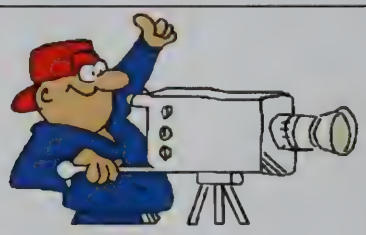

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Preferred method of receiving articles is from **Microsoft Word**, **Open Office** or ASCII **Text**, followed by **typewritten** or **hand written** (clearly). Diagrams or pictures (B&W or Color) can be sent in hard copy, or if you scan them in, save to TIF, JPG or BMP formats (actually I can read about anything). If you send a computer disk, make sure it is PC (not MAC) format. When sending in digital photos or scanned photos, please send us the highest possible resolution for best quality when we print it.

Article submissions can be sent to:

Bill Brown WB8ELK
107 Woodlawn Dr.
Madison, AL 35758

or to our email address: **wb8elk@atvquarterly.com**
Also note our web page address: **http://www.atvquarterly.com**

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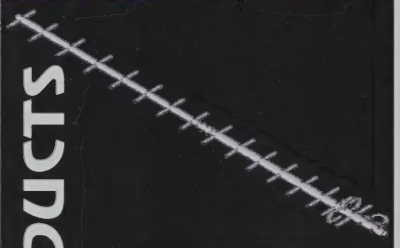

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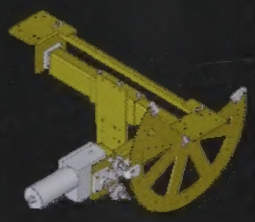

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Payment for Technical Articles

ATVQ will pay for certain articles that it publishes. I will outline the policy here, but it will be subject to change as needed to make sure that ATVQ continues to be an ongoing publication. ATVQ will pay $25.00 for technical articles that are published and are a minimum of 2 pages. While this is not a great amount, I hope it will encourage more technical type articles to be written. Exceptions will be articles that are written by a manufacturer/seller of equipment that is being written about. While I do not want to discourage this type of article, the article itself is an advertisement of the product. Articles from clubs will be encouraged, and I would expect they would like to share their information with the ATVQ readership. Information gathered from the Internet will not be paid for and is mostly small filler items.

Ideas

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ATCO NEWSLETTER

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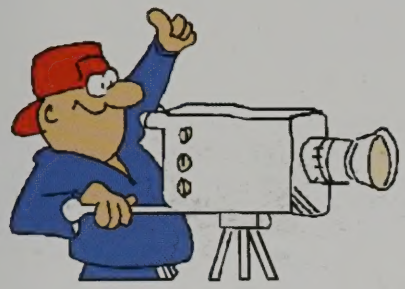

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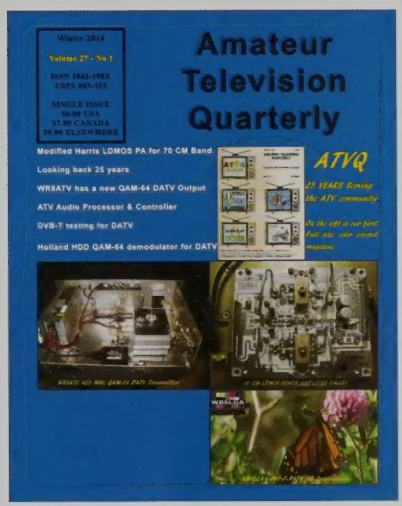
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